

ture, which they have been supposed to do by the stomata interspersed on their surface. This, however, is not their natural action; and they assume it only in forced situations, when they procure no water by means of the roots, either from having been deprived of these organs, or from their being left totally dry. Thus, a branch separated from the trunk, may be preserved from withering for a long time, if the leaves be immersed in water; and when the soil has been parched by a long drought, the drooping plants will be very quickly revived by a shower of rain, or by artificial watering, even before any moisture can be supposed to have penetrated to the roots.

It is by the extremities of the roots alone, or rather by the spongioles which are there situated, that absorption takes place: for the surface of the root, being covered in every other part by a layer of epidermis, is incapable of performing this office. It was long ago remarked by Duhamel, that trees exhaust the soil only in those parts which surround the extremities of the roots: but the fact that absorption is effected only at those points has been placed beyond a doubt by the direct experiments of Sennebier, who, taking two carrots of equal size, immersed in water the whole root of the one, while only the extremity of the other was made to dip into the water, and found that equal quantities were absorbed in both cases; while, on immersing the whole surface of another carrot in the fluid, with the exception of the extremity of the root, which was raised so as to be above the surface, no absorption whatever took place. Plants having a *fusi-form*, or spindle-shaped root, such as the carrot and the radish, are the best for these experiments.

In the natural progress of growth, the roots are constantly shooting forwards in the direction they have first taken, whether horizontally, or downwards, or at any other inclination. Thus, they continually arrive at new portions of soil, of which the nutritive matter has not yet been exhausted; and as a constant relation is preserved between their lateral extension and the horizontal spreading of the branches, the